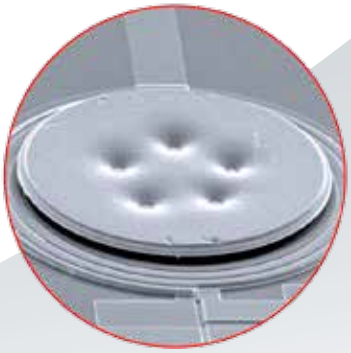
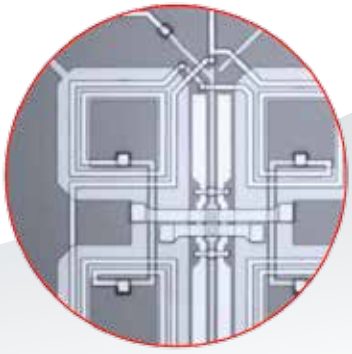
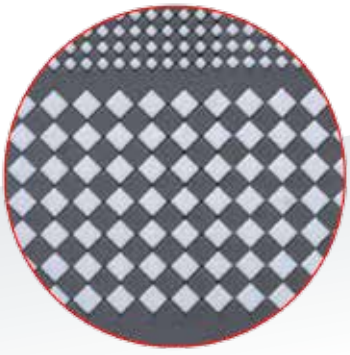
HEIDELBERG INSTRUMENTS

MLA300

The Maskless Aligner for Volume Production







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HEIDELBERG INSTRUMENTS

MLA300
THE MASKLESS ALIGNER FOR VOLUME PRODUCTION

The MLA300 features our powerful Maskless Aligner technology that has been specifically adapted to the requirements of high-throughput production applications: You can now employ the unmatched flexibility of maskless lithography in an industrial setting, on wafers with sizes up to 300 x 300 mm². Lithography no longer depends on a fixed mask, but can dynamically adapt to surface and process variations from previous fabrication steps.

A Maskless Aligner for Industry

The MLA300 is based on the Heidelberg Instruments Maskless Lithography technology, which has become a standard in Research & Development applications, rapid prototyping, and low-to mid-volume production.

The MLA300 is the industrial production version of the Maskless Aligner, with outstanding specifications: It achieves high resolutions of 2 µm lines and spaces at the high throughput and high availability expected in production. It features full automation with wafer robot and load ports, and software specifically designed for the production environment to offer a simplified automated workflow.

The Maskless Technology

The Maskless Aligner technology uses a Spatial Light Modulator which essentially acts like a dynamic mask. It offers the flexibility to structure the most challenging substrates, allowing per-die pattern corrections (e.g. to react to distortions or process variations), and employs a real-time autofocus to follow substrate warp or corrugations. The non-contact exposure gives the system an unmatched durability and reliability.

The MLA300 at a Glance

- Maskless technology
- Highly flexible (accomodates even warped substrates)
- For volume production
- Fully automated
- Low cost of ownership
- Modular design concept

The overheads and expense associated with the procurement of masks, and their handling, cleaning, and storage are also eliminated.

The system is designed for low total cost of ownership with its long-life diode laser and no consumables requirements. The positioning system is based on a frictionless air-bearing table, which offers high speed and high-accuracy motion, while simultaneously optimizing durability and lifetime.

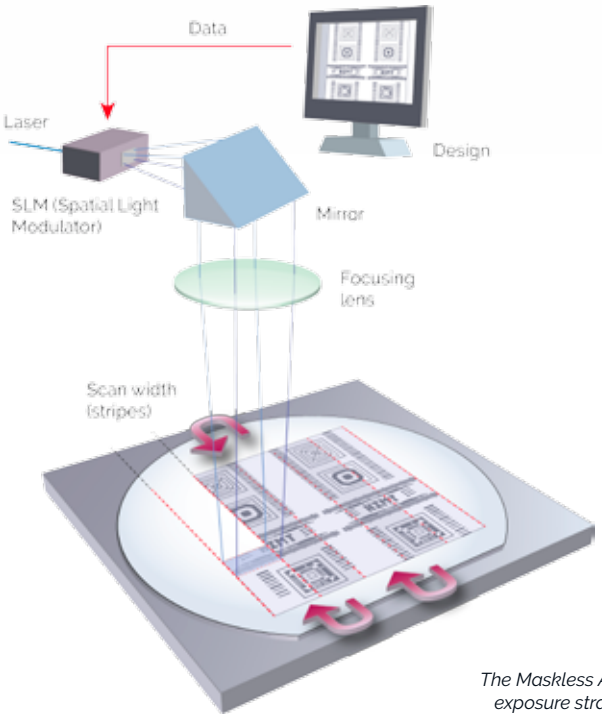
Applications

The MLA300 excels in application areas such as the production of sensors, sensor ICs, MEMS devices, discrete electronic components, analog and digital ICs, ASICs, Power electronics, OLED displays, as well as for advanced packaging applications.

Maximum Flexibility

The novel modular concept allows maximum flexibility for the MLA300, which can thus be tailored to the production task and facility requirements. The loader module can be configured to interface to existing substrate carrier or FOUP systems and ensures seamless integration to the production line.

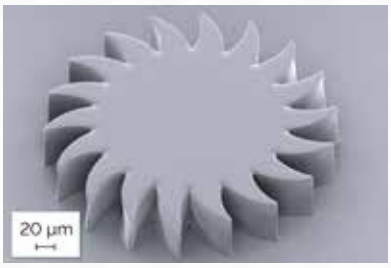
The fully integrated exposure modules are available for a selection of wavelengths (375 nm or 405 nm) and with different resolution options. Multiple exposure modules can be mounted in the MLA300, either operating a single module optimized for the product and resist (wavelength, resolution or throughput), or operating multiple identical modules simultaneously for further increased throughput.



The Maskless Aligner exposure strategy

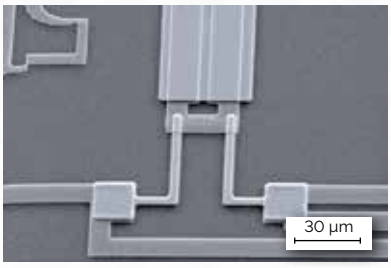
MASKLESS LITHOGRAPHY IN INDUSTRIAL PRODUCTION: APPLICATION AREAS

MEMS



MEMS processes integrate standard microchip technologies with electromechanical components of a diverse range of sizes and materials. Stresses and stress-induced deformations need to be managed carefully to yield correct device properties. The Maskless Aligner technology is ideally suited to make on the fly corrections to the design if required.

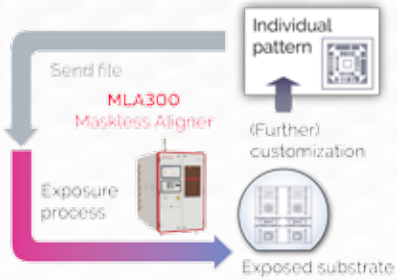
Sensors



Maskless lithography provides the extreme overlay accuracy which is central to applications in the sensor field: The production of SQUID devices may involve as many as 18 layers and high-resolution features. The alignment between layers is crucial to the production yield, and is completed automatically with the Maskless Aligner technology (impressively demonstrated here by the MLA150).

This and SQUID images on front page:
Courtesy of the Kirchhoff Institute for Physics (KIP), Heidelberg University

Customized Products



The benefit of Maskless Lithography is the inherent rapid turnaround and adaptation of the exposed patterns. Adaptations for customized products or even simply a large product portfolio no longer entail the time and cost of production and maintenance of an expensive mask set. Switching between product types is seamless, and does not require intervention to change masks.

Flexible Substrates

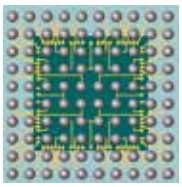
Structuring flexible substrates is challenging as the shape and the distortions vary with applied forces. Maskless lithography offers the unique option of exposing the substrates with warpage-dependent pre-distortions, to maximise yield

MLA300 – Applications and Benefits in a Nutshell

- ✓ Sensors
- ✓ Electronic Components
- ✓ Analog and Digital ICs
- ✓ Advanced Packaging
- ✓ MEMS
- ✓ Military
- ✓ Photovoltaic
- ✓ Electronic probes

- ✓ High throughput
- ✓ Dynamic distortion correction
- ✓ Handling of challenging substrates (warpage!)
- ✓ Contactless exposure
- ✓ High precision and overlay accuracy
- ✓ Flexible pattern adaptations and alterations
- ✓ Individual labeling
- ✓ Confidentiality
- ✓ Quick time to market
- ✓ Quick turnaround time
- ✓ Low cost of ownership

Wafer-Level Packaging



Fan-out wafer-level technology helps to achieve a high I/O-density and allows the flexible, heterogeneous integration of multiple chips. Challenges include varied chip heights and warped substrates. These can be solved by the benefits provided by Maskless Lithography: A special wafer handling system, customizable vacuum chucks, and a large autofocus compensation range.

Electronic Components

Electronic components are often produced on substrate materials such as ceramics which are selected for their robustness or thermal properties rather than surface quality. The Maskless Aligner technology flexibly follows surface warp and corrugations, increasing uniformity and yield. Process variations can also be compensated for dynamically by adjusting the exposed pattern.

Electronic Probes

Tailor-made probe cards allow the testing of an entire wafer of computer chips in one go. In the production of these probe cards, the challenge lies in the alignment through very thick photoresists and the often warped ceramic substrates. MLA300 technology solves both problems through an increased travel range of its autofocus system up to 200 µm.

MLA300
SYSTEM SPECIFICATIONS

Writing performance	
Minimum lines and spaces [µm]	2
Minimum feature size [µm]	1.5
CD uniformity [3σ, nm]	200
Edge roughness [3σ, nm]	80
Stitching [3σ, nm]	120
2nd layer alignment [3σ, nm]	500
Backside alignment [3σ, nm]	1000
Exposure time per module (100 x 100 mm^2 at 50 mJ/cm^2 and 405 nm laser wavelength)	2.6 min
Maximum write speed with one module at 405 nm laser wavelength	5000 mm^2/min
System features	
Light source	Laser wavelength: 375 nm and 405 nm High power diode laser with long life-time
Maximum substrate size	300 x 300 mm^2
Maximum exposure area	300 x 300 mm^2
Substrate thickness	0.1 - 10 mm
Modular environmental chamber	Temperature stability ± 0.1°C
Real-time autofocus	Optical and/or pneumatic autofocus
Autofocus dynamic range	Up to 150 µm
Alignment	Advanced alignment; backside alignment optional
Automation	Automatic wafer handling and pre-alignment
System dimensions (excluding loader)	
Height × width × depth	1980 mm x 1200 mm x 2310 mm
Weight	2600 kg
Installation requirements	
Electrical	400 VAC, 50/60 Hz, 16 A

Please note: Specifications depend on individual process conditions and may vary according to equipment configuration. Write speed depends on exposure area and resist sensitivity and thickness. Design and specifications are subject to change without prior notice.

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The power of direct writing

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